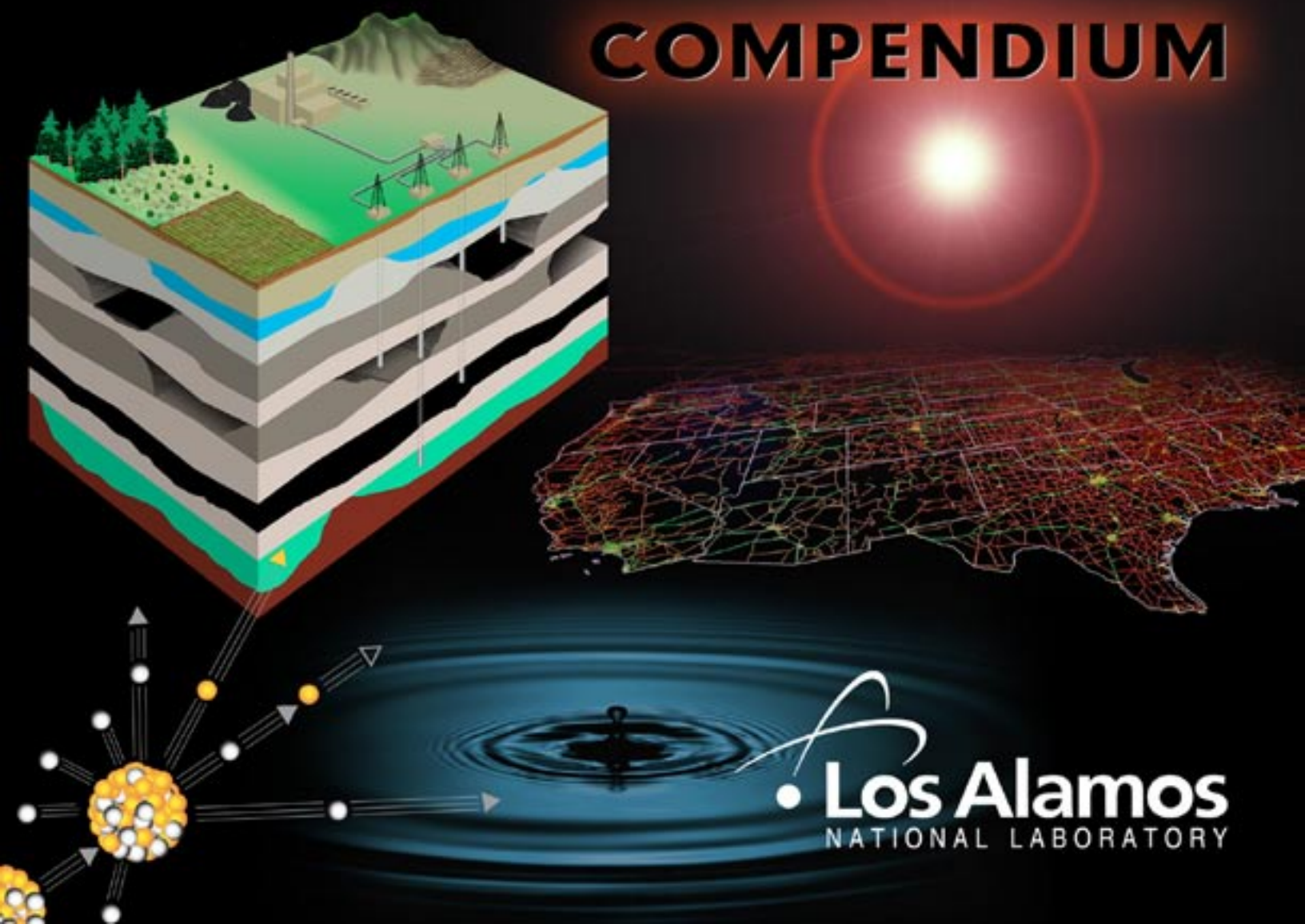


# Energy and Environment

## COMPENDIUM



Los Alamos  
NATIONAL LABORATORY

# Energy and Environment

## **COMPENDIUM**

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# A Comprehensive Approach to National Security

While the nation is preoccupied with hostile threats from abroad, it is easy to forget that other issues could undermine our national security and well-being. Chief among these are the intertwined issues of energy production and environmental sustainability. The nation's security and economic stability rely on sufficient energy supplies and environmentally sound practices of energy production and use. Yet parts of the U.S. have already experienced shortages as electricity demand increases far more rapidly than new generating capacity, and 52% of the nation's primary transportation fuel source is imported from an unstable foreign market (projections show those imports at 70% by 2020). U.S. dependence on these oil-rich regions has had, and continues to have, a direct impact on national security.

Furthermore, increases in atmospheric carbon, caused by current methods of energy production and use, threaten to change the climate in potentially disastrous ways that are little understood at present. The burning of fossil fuels has raised atmospheric levels of carbon dioxide to 380 ppm, significantly higher than at any other time within the last 420,000 years. The effects of this greenhouse gas may become intolerable as those levels approach 500 ppm by the middle of the century. As we reach and exceed this limit, polar ice caps will melt, ocean salinity will decrease, ocean currents may reverse, and life on Earth could change irreversibly.

The nation's, and the world's, greatest challenge over the next several decades will be to halt the progress of global warming but still provide enough energy to maintain a high quality of life in developed countries while raising the standard of living in developing regions of the world. To meet this challenge we must

- transition to energy sources that do not produce greenhouse gases,
- capture and store CO<sub>2</sub> from continued fossil fuel use during the transition period,
- reduce fuel consumption through increased efficiency, and

- protect diminishing water resources by developing less water-intensive energy generation methods.

Los Alamos National Laboratory, a science and technology pioneer and leader in defending America for over 50 years, recognizes that U.S. national security now extends far beyond the need for a strong military defense. Because so much of national stability in the 21<sup>st</sup> century revolves around issues of energy and the environment, Los Alamos's integrated Energy and Environment Program is applying the Laboratory's multidisciplinary expertise, which has served the nation so well in nuclear defense, to solve national issues of energy security and the interrelated global issues of environmental sustainability. The Laboratory is leading initiatives to

- ensure a stable, non-polluting supply of energy for the future;
- modernize and increase the efficiency of the nation's energy infrastructure;
- prevent carbon emissions from entering or remaining in the atmosphere;
- increase the safety and viability of nuclear energy production;
- ensure an abundant and clean supply of water;



Los Alamos National Laboratory  
in northern New Mexico.

- simulate and understand the interdependencies of infrastructure systems; and
- model and predict the effects of climate change.

The nation's huge investment in Los Alamos National Laboratory has fostered a host of unique scientific and technological capabilities that can be applied to many challenges apart from military defense. Recognizing this, many of Los Alamos's scientists and engineers have asked, what if we could take the Laboratory's capabilities and

- convert the U.S. transportation economy into a clean, domestically-fueled hydrogen-based system?
- continue to use coal, our cheapest and most abundant resource, but eliminate the harmful greenhouse gas emissions?
- replace our electricity transmission lines with superconducting cables that transfer *all* the electricity from generators to users with no current loss?
- prevent global climate change by accelerating natural carbon intake processes (biological and mineral)?
- store industrial CO<sub>2</sub> emissions in safe geological wells and at the same time use them to increase production of natural gas?

- reduce the hazards of generating nuclear energy by making the waste less harmful and unsuitable for weapons production?
- predict the regional effects of global climate change and address problems before they arise?
- predict any harmful effects of electricity deregulation before they occur, or foresee vulnerabilities in our electric and transportation systems before they fail or are exploited maliciously?
- make untapped, non-potable water reserves available for industrial use and electricity generation to relieve overburdened freshwater resources?

Los Alamos already has a long history of turning these and other related visions into reality, and the Laboratory has long worked with industry to bring innovations into practical development and use.

This publication presents much of the research and development that Los Alamos National Laboratory is performing to ensure our nation's energy security and environmental sustainability. To obtain the most current information about Los Alamos National Laboratory's energy and environment research and development, visit us on the Internet at <http://www.lanl.gov/energy>.